March 18, 1941. P. KOMROFF 2,235,022

AIR CONDITIONING APPARATUS

Filed Oct. 21, 1937 4 Sheets-Sheet 1

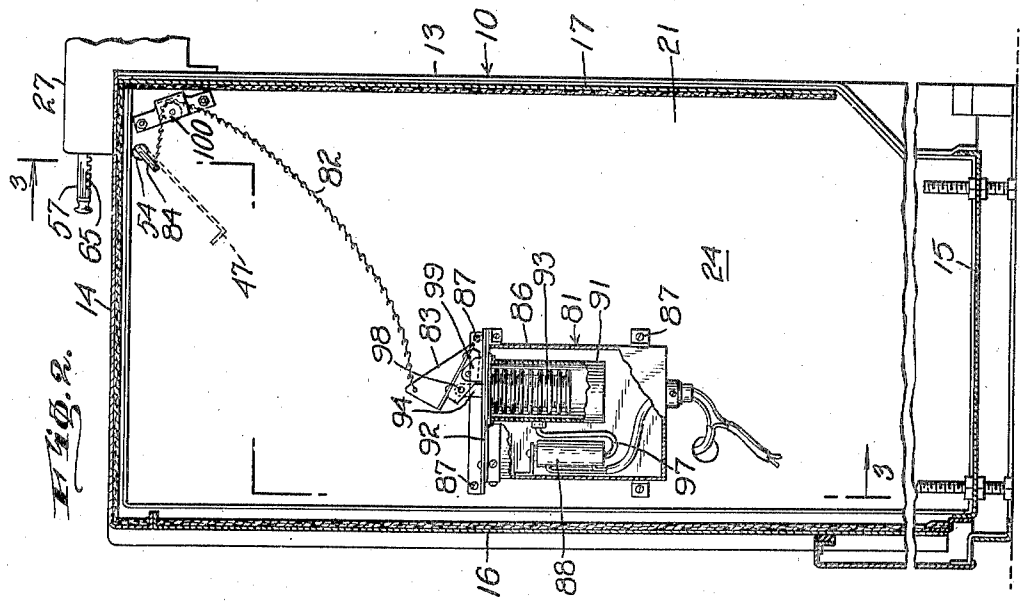


Fig. 2.

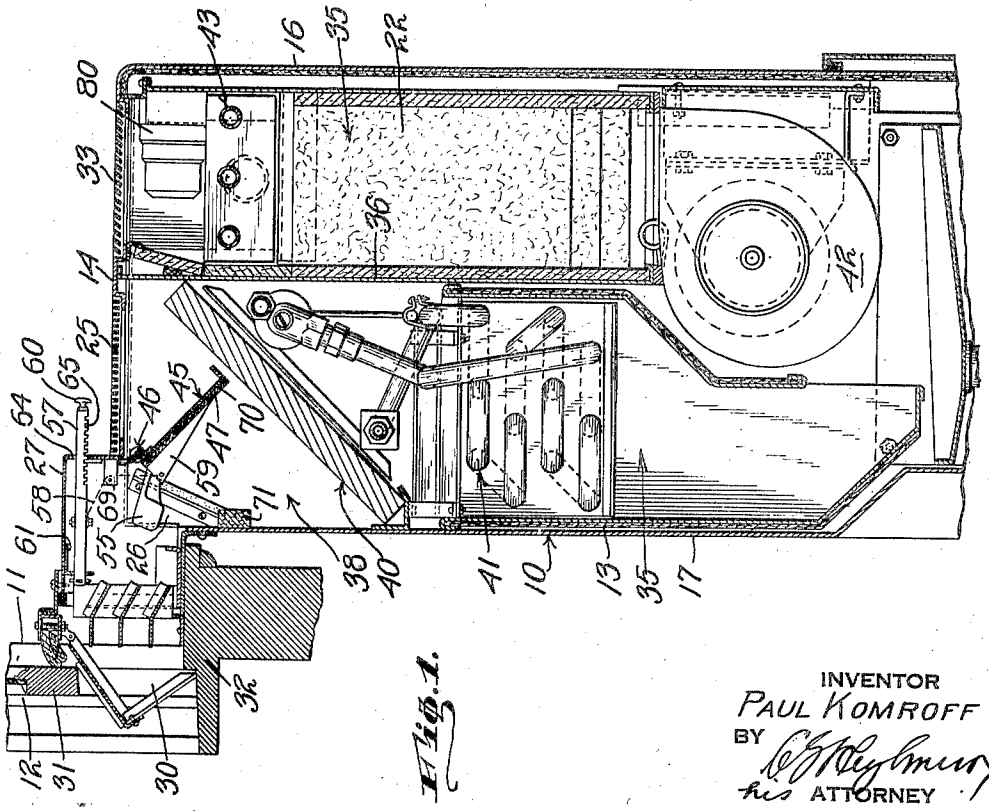


Fig. 1.

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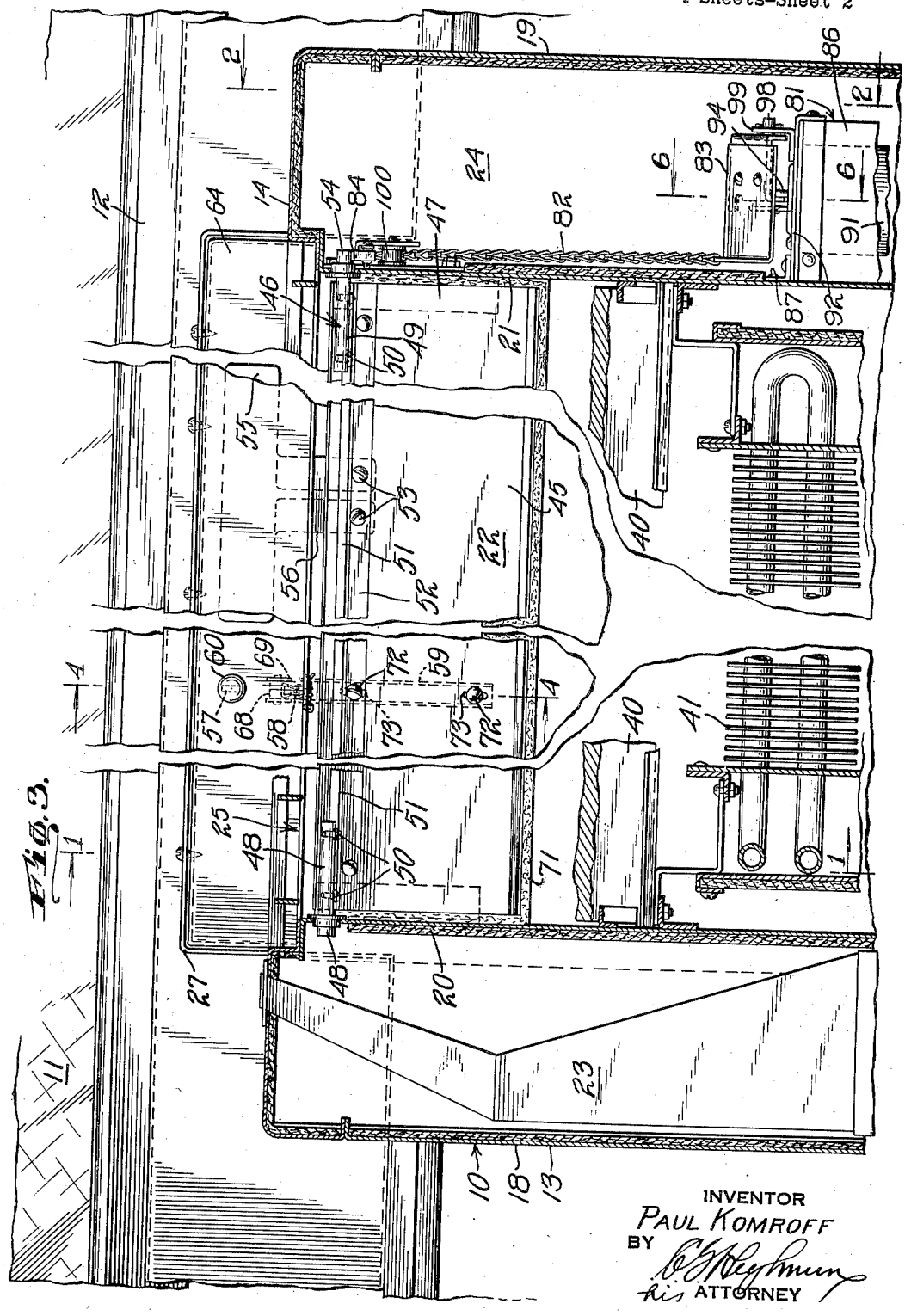


Fig. 3.

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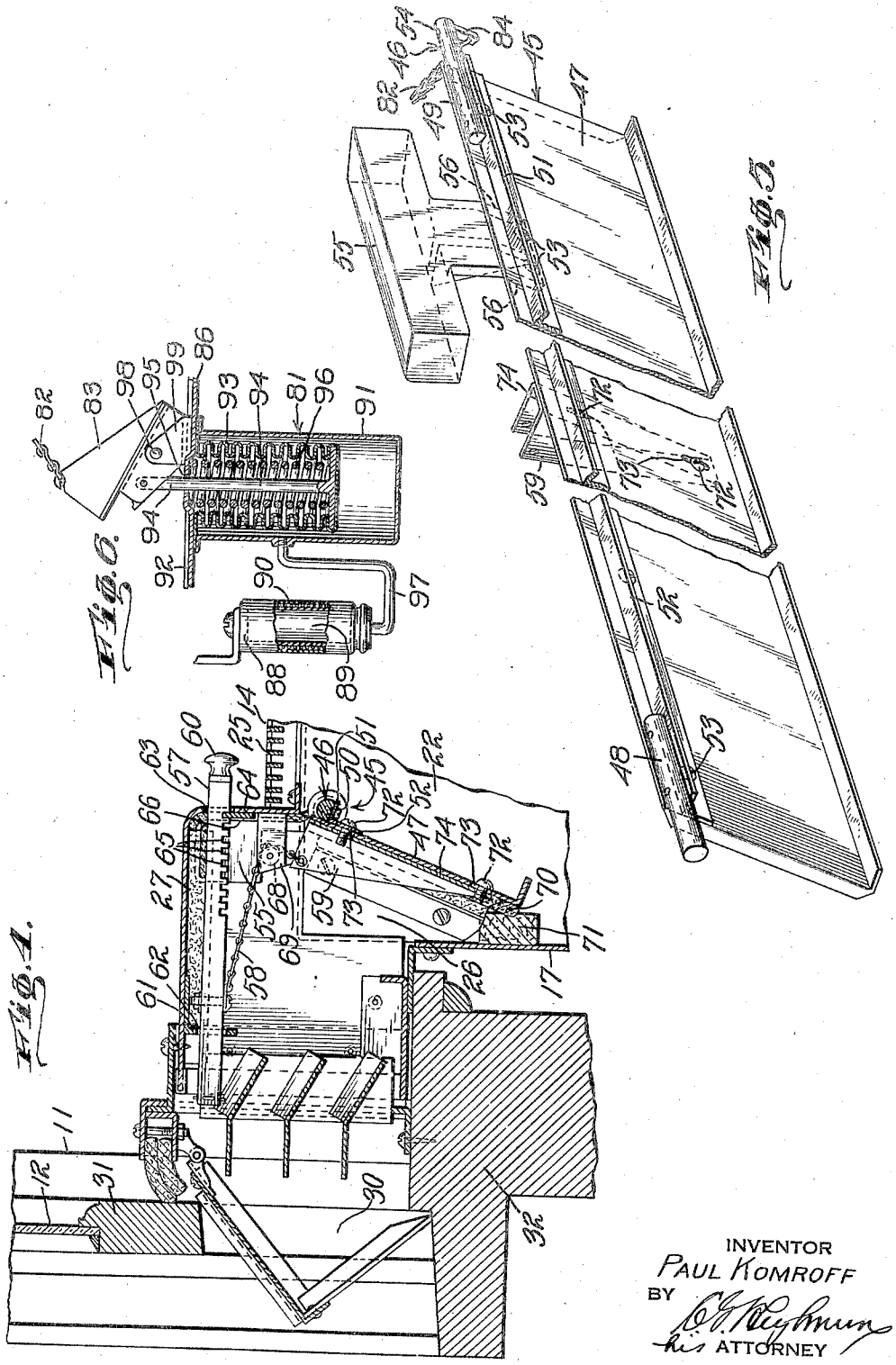


Fig. 4.

Fig. 6.

Fig. 5.

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AIR CONDITIONING APPARATUS

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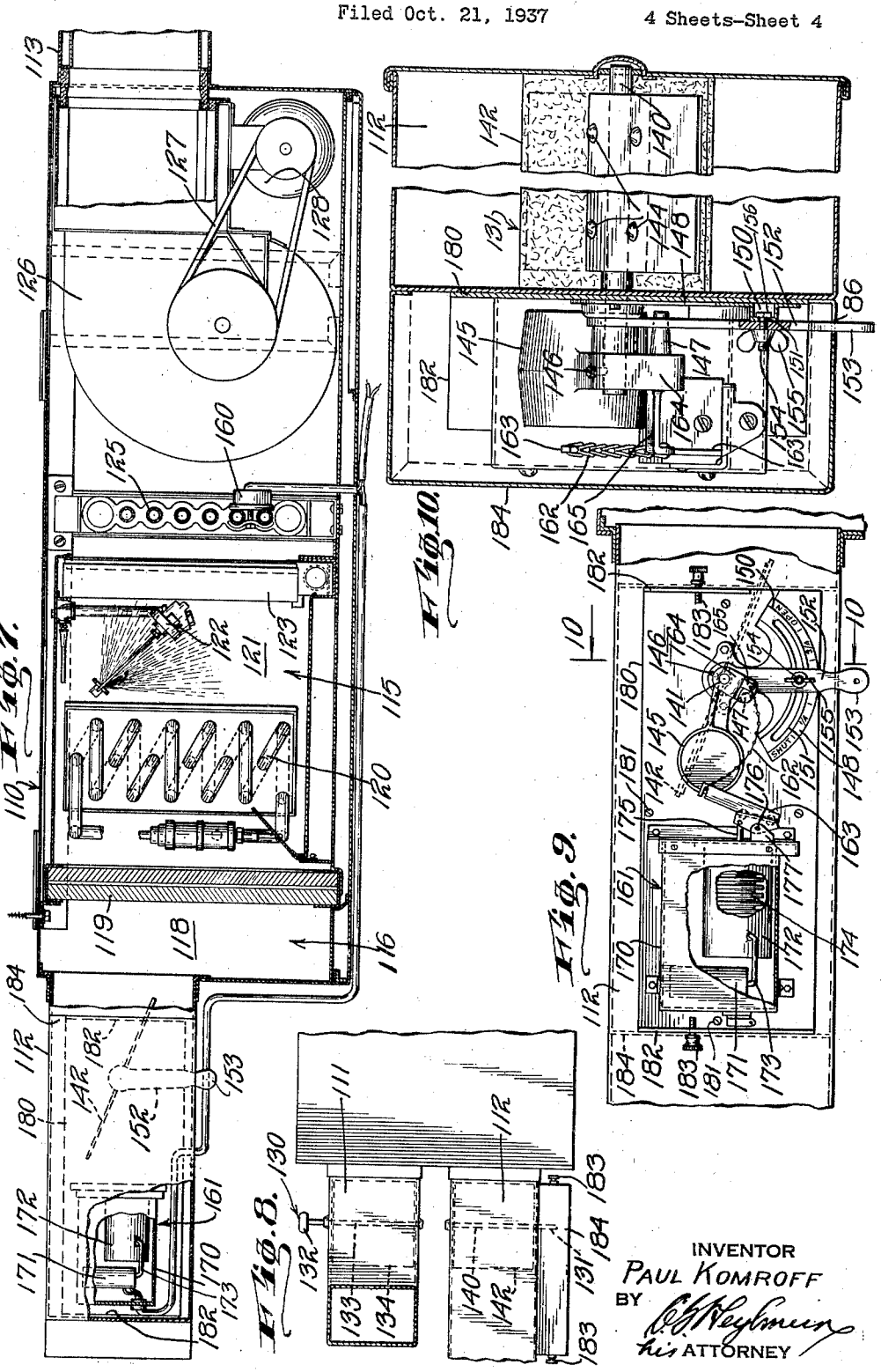


Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

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Patented Mar. 18, 1941 2,235,022

UNITED STATES PATENT OFFICE

2,235,022

AIR CONDITIONING APPARATUS

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Application October 21, 1937, Serial No. 170,167

11 Claims. (Cl. 98—38)

This invention relates to air conditioning apparatus, and more particularly to mechanisms for operating the dampers controlling the admission of outside air; the present case being directed to the same general type of apparatus as is disclosed and claimed broadly in U. S. Patent No. 2,209,800, granted July 30, 1940, to Matson C. Terry.

The invention consists in the novel construction and combination of parts, to be more fully described hereinafter, and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, in which drawings—

Fig. 1 is a transverse vertical section showing air conditioning apparatus constructed in accordance with the present invention, the section being taken on the line 1—1 of Fig. 3;

Fig. 2 is also a transverse vertical section of the air conditioning apparatus, the section being taken on the line 2—2 of Fig. 3;

Fig. 3 is a fragmentary longitudinal vertical section taken on the line 3—3 of Fig. 2, and showing the parts on an enlarged scale;

Fig. 4 is a fragmentary vertical section taken on the line 4—4 of Fig. 3, and with the scale the same as Fig. 3;

Fig. 5 is a fragmentary perspective view showing in detail the construction of the damper;

Fig. 6 is a fragmentary vertical section through the heat motor used for automatically closing the damper, the section being taken on the line 6—6 of Fig. 3;

Fig. 7 is a vertical longitudinal sectional view showing a modified form of my invention as embodied in air conditioning apparatus of the type usually installed in a room of a building remote from the room to be conditioned;

Fig. 8 is a fragmentary plan view of the left-hand end of the apparatus as viewed in Fig. 7;

Fig. 9 is a side elevation of the structure which is shown at the left-hand end of Fig. 7, with certain of the parts being broken away and with the cover removed to show more clearly the damper operating mechanism; and

Fig. 10 is a fragmentary transverse vertical section taken on the line 10—10 of Fig. 9.

Referring now in detail to the construction illustrated, and first to the embodiment of my invention disclosed in Figs. 1 to 6 inclusive, the reference numeral 10 indicates air conditioning apparatus of the unit-type which is adapted to be arranged within a room space of a building adjacent a wall thereof having a window, and which is adapted to receive outside air through an opening defined by the partially raised window sash. The window is indicated at 11 and the window sash at 12.

The unit 10 comprises a casing 13 which is adapted to rest on the floor of the room, and includes a top wall 14, a bottom wall 15, a front wall 16, a rear wall 17, an end wall 18 and an end wall 19. The interior of the casing is divided by spaced vertical partition walls 20 and 21 into a central section 22 and end or wing sections 23 and 24, respectively (see Fig. 3).

In the rear of the top wall 14 and extending across the central section 22 is an air inlet opening 25 which communicates with the room space. A second air inlet opening 26 is provided at the upper and extreme rear of the casing, and also extends for the length of the central section 22. The inlet opening 26 is connected to the outside atmosphere by a duct section 27, communicating at one end with the inlet opening 26 and extending rearwardly from the casing 13, and communicating at its other end with an opening 30 defined by the lower sash rail 31 of the window sash 12 and the window sill 32. In the forward part of the top wall 14 is provided an air outlet opening 33 which also extends for the full length of the central section 22 and communicates with the room space.

Connecting the inlet openings 25 and 26 with the outlet opening 33 is a U-shaped passage 35 defined by the partition walls 20 and 21, the front wall 16, the rear wall 17, and by a vertical partition wall 36 arranged in spaced parallel relation with the walls 16 and 17 and depending from the top wall 14 at points between the inlet opening 25 and outlet opening 33.

It is to be observed at this point that in so far as the broader aspects of my invention are concerned, the U-shaped passage 35 may be considered as a part of a main air passage 38 connecting the outside atmosphere with the room space, the other part of such main air passage 38 being provided by the duct section 27.

Arranged below the inlet openings 25 and 26, and extending diagonally across the U-shaped passage 35, is a suitable filter 40 which functions to remove solid particles, such as dust, dirt, pollen and the like, from the air flowing through the U-shaped passage 35. Arranged below the filter 40 is a suitable cooling element, here shown to be in the form of a conventional type of cooling coil 41, through which a refrigerant fluid is adapted to be circulated during the summer season. Any suitable type of refrigerant may be supplied to the interior of the coil 41, such, for example, as sulphur dioxide, Freon, or the like.

Arranged in the lower part of the U-shaped passage 35 is a motor-driven blower 42 which provides for the positive flow of air through the duct 27, the U-shaped passage 35 and into the room through the outlet opening 33. Arranged

in the upper and outlet end of the U-shaped passage **35** and directly below the outlet opening **33** is a heating coil **43** which may be of any conventional construction and may be supplied with any suitable kind of heating fluid, for example, steam or hot water.

The apparatus so far described is of the same general type as is disclosed in U. S. Patent No. 2,214,467, granted September 10, 1940, to Robert D. Lambert, et al. The operation of apparatus of this type is as follows: During the summer or warmer months of the year, a suitable refrigerant fluid is supplied to the interior of the coil **41**; and the air flowing through the U-shaped passage **35** and into the room space will therefore be reduced in temperature as it flows over the exterior surfaces of the coil **41**. During the winter time, the supply of refrigerant is shut off from the coil **41** and a suitable heating fluid is supplied to the interior of the coil **43**. Then, the air flowing through the U-shaped passage **35** and into the room through the outlet **33** will be increased in temperature as it passes over the exterior surfaces of the coil **43** and will therefore serve to maintain the desired comfort condition in the room space.

In apparatus of this type, it is highly desirable, both in summer and in winter, that the proportional amounts of outdoor air and room air entering the U-shaped passage **35** through the inlet openings **25** and **26** be carefully regulated. It is also highly desirable both in summer and winter to shut off the supply of outdoor air in case the element which is operating to condition the air, fails to operate. The latter is desirable in the summer time so that when the cooling coil **41** is shut off, the desired temperature condition in the room space will not be seriously affected due to admission of warm outside air. This is also desirable in the winter time for the reason that admission of cold outside air, when the heating coil **43** is not operating, will cause cold drafts in the room, and thereby disturb the desired comfort condition. Another important reason why outside air should not be admitted to the room during cold weather when the heating coil **43** is shut off, is that it might result in the freezing and consequent damaging of those parts of the unit which contain water.

In order that the proportionate amounts of room air and outside air flowing through the inlets **25** and **26**, respectively, may be properly regulated, I provide a damper means, indicated in general by the reference character **45** and comprising a horizontal shaft part **46** journaled in the partition walls **20** and **21** at points between the inlet openings **25** and **26**, and a damper element **47** fixed at its upper longitudinal edge to the shaft part **46** and movable between two extreme positions, one of which closes the opening **26** and opens wide the opening **25** and the other of which closes the opening **25** and opens wide the opening **26**. The damper element is shown in a mid portion in Fig. 1 and in a position closing the inlet opening **26** and opening wide the opening **25** in Fig. 4.

The shaft part **46** is here shown as comprising a pair of stub shafts **48** and **49** which are journaled in the walls **20** and **21**, respectively, and which are fixed to the damper element **47** by screws **50** extending through a flange **51** of an angle **52**, the latter extending longitudinally of the upper part of the damper element and being fixed to the latter by a plurality of spaced bolts **53** (see Figs. 3 and 5). The stub shaft **49** is provided with an extension **54** which extends through the wall **21** and into the end compartment **24** of the casing **13** (see also Fig. 2).

In accordance with the present invention, I provide a manually-operated means for placing the damper element **47** at any preselected position desired by the operator of the apparatus. This means comprises a device for constantly urging the damper element toward the extreme position to open wide the inlet opening **26**, and incidentally the main air passage **38**, and also comprises a manually adjustable stop device for limiting movement of the damper element **47** by the urging device to any preselected position.

The urging device is here shown as comprising a counterweight **55** secured to the damper element **47** by two of the bolts **53** which also serve to secure the angle member **52** to the damper element **47**, these two bolts **53** passing through the element **47** and through a flange part of foot **56** provided on the counterweight **55**. As can be seen from Figs. 1, 4, and 5, the counterweight **55** is so arranged with respect to the damper as to constantly urge the damper toward the position where the inlet opening **26** is full-open and the inlet opening **25** is full-closed.

The manually-adjustable stop device for limiting movement of the damper element **47** by the counterweight **55** to any one of a number of selected positions is here shown as comprising a longitudinally movable rod **57** connected to the damper element **47** by a flexible chain **58** and bracket **59** (see Fig. 4). The rod **57** is adapted to be moved lengthwise forwardly and rearwardly by hand, and to this end is provided at its forward or outer end with a suitable knob **60**. The rear of the rod **57** is supported for lengthwise movement by a bracket **61** having an opening **62** through which the rod extends. The forward end of the rod **57** extends through an opening or slot **63** in a wall **64** of the duct **27**, and the underside of the rod **57** is provided with a series of spaced notches **65**, each of which is adapted to engage, when desired, a stop element in the form of a vertical plate **66** fixed to the inside surface of the wall **64** and projecting slightly above the bottom of the slot **63**. The upper part of the plate **66** is spaced from the top of the slot **63** sufficiently to permit the rod **57** to be raised to a point where the notches **65** may clear the plate **66** and the rod **57** moved lengthwise as desired to any selected position.

It will thus be seen that as the damper element **47** is constantly urged by the counterweight **55** towards the extreme position where the inlet opening **26** is open, the chain **58** is always kept taut, and any movement of the rod **57** inwardly or outwardly will result in movement of the damper element **47** to close and open the inlet **26**. In order to secure proper transmission of forces between the rod **57** and damper element **47** for opening and closing the latter, the chain **58** passes over a pulley **68**, which is supported by a suitable bracket **69** from the wall **64**.

In order to assure the tight closing of the inlet opening **26**, a strip **70** of a relatively soft material, such, for example, as felt, rubber or the like, is secured to the damper element **47**; and a strip **71** of similar material is secured to the rear wall **17** of the casing **13** and adapted to be engaged by the strip **70** when the damper closes the inlet opening **26**.

In order to make certain that the inlet opening **26** is closed tight when the plate **66** engages a notch **65** at the forward end of the rod **57**, the

bracket 59 is secured to the damper element 47 by a lost-motion screw-and-slot connection. This connection is provided by screws 72 passing through slots 73 in the element 47 and into threaded openings in a flange 74 of the bracket 59. With the screws 72 loosened, the bracket 59 may be moved, as permitted by the slots 73, to obtain the proper relationship between the parts, and the screws 72 may then be tightened to maintain such relationship.

In accordance with the present invention, I also provide a means which acts in response to changes in an operating characteristic of a conditioning element for moving the damper element 47 from any preselected open position to its closed position when such conditioning element ceases to operate for any reason. In the apparatus here shown, this means acts in response to the temperature of the air flowing from the heating coil 43, and will operate to close automatically the inlet opening 26 when the temperature of the air flowing from the coil is reduced to a point where it indicates that the supply of heating fluid has been shut off from the coil 43.

In so far as the broader aspects of this invention are concerned, the conditioning element may be either the heating or the cooling coil. The expression "an operating characteristic of the air conditioning element or means" as used herein and in the appended claims, is intended to mean any condition which reflects the operation of the air conditioning means; that is to say, any condition which indicates or shows whether or not the air conditioning means is operating, or its degree of operation, or the air conditioning effect produced by the air conditioning means because of its operation. One example of an operating characteristic of the air conditioning means would be the temperature of the air leaving the heating coil 43, as described above. The temperature of the air leaving the coil changes with the heat output of the coil and thereby indicates whether or not the coil is operating. Other examples of operating characteristics of an air conditioning means would be the surface temperature of a heating or cooling coil; the temperature of a heating or cooling medium flowing through a heating or cooling coil; the rate of flow of a cooling or heating medium through a coil; and the pressure of the fluid inside of a coil as in the case of a steam coil and in the case of a refrigerant in a cooling coil. Obviously, any operating characteristic of the air conditioning means may be used as a source of control for the opening and closing of the damper 45, without departing from the intended scope of the present invention.

The means for automatically moving the damper element 47 to close the inlet opening 26, comprises a thermostat 80 positioned in the passage 35 above the heating coil 43, a heat motor 81 connected in series in an electric circuit with the thermostat 80, and a flexible chain 82 connected at one end to a lever 83 actuated by the heat motor 81 and connected at its other end to the outer end of a lever arm 84 which is keyed to the extension 54 of the stub shaft 49 to which the damper element 47 is fixed. The heat motor 81, chain 82, lever 83 and lever arm 84 are advantageously positioned outside of the main air passage 35 and in the wing section 24 of the casing 13 (see Figs. 2 and 3).

The thermostat 80 may be of any suitable construction. The one here shown operates to maintain the aforementioned electric circuit closed when the temperature of the air flowing from the coil 43 is at a value which indicates that there is heating medium in the coil; and, operates to open such electric circuit when the temperature falls to a value which indicates that the supply of heating medium has been cut off from the coil 43.

The structural details of the heat motor 81 can be understood more readily from an examination of Figs. 2 and 6. The heat motor 81 comprises a housing 86 arranged within the wing section 24 and fixed to the partition wall 21 by suitable screws 87. Within the housing 86 is positioned a heating element 88 which comprises a chamber 89 surrounded by an electrical resistance element 90 connected in series in the circuit controlled by the thermostat 80. Within the housing 86 is also located a cylinder 91 secured at one end to the top wall 92 of the housing 86, and within the cylinder 91 is located an expansible bellows 93 fixed at one end to the top wall 92 and connected at its other and movable end to an operating rod 94, the latter extending longitudinally through the bellows 93 and protruding through an opening 95 in the top wall 92. Encircling the operating rod 94 is a compression spring 96 which abuts at one end the top wall of the housing and abuts at its other end the movable end of the bellows 93.

The interior of the bellows 93 communicates with the atmosphere through the opening 95 and the construction is such that fluid in the cylinder 91 cannot leak into the bellows. The interior of the cylinder 91 is in communication with the interior of the chamber 89 by a suitable capillary tube 97 and the interior of the chamber, the cylinder, and the tube are charged with any suitable expansible fluid, such, for example, as acetone, alcohol, ethyl chloride, or the like.

When there is heat in the coil 43 and the thermostat 80 closes the electrical circuit containing the resistance element 90, the latter heats and vaporizes the fluid in the chamber 89. As a result, the pressure of the fluid in the chamber 89, cylinder 91 and tube 97 increases and the bellows is contracted against the force of the spring 96 and moves the operating rod 94 upwardly, as viewed in Fig. 6. When the supply of heating medium is cut off from the coil 43 and the thermostat 80 opens the electrical circuit, the vaporized fluid in the chamber 89 condenses, thereby lowering the pressure of the fluid in the cylinder 91 and permitting the spring to expand again the bellows 93 and move the rod 94 to a lower position. The position of the parts as shown in the drawings corresponds to the compressed or contracted position of the bellows.

The upper end of the rod 94 is operatively connected to the lever 83, and the latter is supported by a fulcrum pin 98 passing through a bracket 99 fixed to the top wall 92 of the housing 81. As stated, the chain 82 is connected at one end to one end of the lever 83, and at its other end to the end of the lever arm 84. When the heating element 88 is energized and the bellows 93 contracted, the rod 94 moves the lever 83 to its upper position which is shown in Figs. 2 and 5, and in this position the chain 82 is slack; unless, of course, the damper element 47 is in the position where the opening 26 is full-open. In the latter case, there will be no slack in chain 82. When the element 88 is deenergized, the spring 96 expands the bellows 93 and pulls the rod 94 and lever 83 down to a lowermost posi-

tion, thereby pulling taut the chain 82, and moving the lever arm 84, stub shaft 49, and damper element 47 against the force of the counterweight 55 and to the position where the inlet 26 is full-closed. In the latter position, the chain 58 will be slack, unless the rod 57 is in the position where the damper element 47 had been previously closed by hand. In order that the force may be properly transmitted between the lever 83 and lever arm 84, the chain 82 passes over an idler pulley 100 suitably supported by the wall 21.

From the above, it will be apparent that the damper element 47 may be positioned at any preselected point by the manual adjustment of the rod 57, and as long as there is heat in the coil 43, the damper element will stay in this preselected position; but, when the supply of heating fluid is shut off from the coil 43, the thermostat 80 and heat motor 81 will act automatically to move the damper element 47 to the position where the opening 26 and main air passage 38 are closed. When the coil 43 is again supplied with a heating medium, the element 88 will become energized, the lever 83 moved to the upper position shown in Figs. 2 and 5, and the chain 82 will become slack, and the counterweight 55 will return the damper element to the position preselected by the position of the manually adjustable rod 57.

In Figs. 7 to 9 inclusive of the drawings, I have shown a slightly modified form of my invention as embodied in air conditioning apparatus of the type which is adapted to be installed in a place remote from the room to be conditioned. The air conditioning apparatus is indicated in general by the reference character 110 and is connected at one end to the ends of a pair of air inlet ducts 111 and 112 and at its other end to one end of an outlet duct 113. The inlet duct 111 is adapted to be connected at its other end to the room to be conditioned and serves to return air from the room to the conditioning apparatus. The inlet duct 112 is adapted to be connected at its other end to the outside atmosphere and serves to supply outdoor air to the conditioning apparatus. The outlet or discharge duct 113 is adapted to be connected at its other end to the room to be conditioned and serves to supply such room with the conditioned air so as to maintain the desired comfort condition therein.

The apparatus 110 is provided with an air passage 115 extending longitudinally therethrough and connected at one end to the inlet ducts 111 and 112 and at its other end to the outlet duct 113. It is to be observed at this point that the passage 115 may be considered as a part of a main air passage 116 connecting the outside atmosphere with the room space to be conditioned, the inlet duct 112 and the outlet duct 113 forming the other parts of this main air passage.

The air in flowing through the apparatus 110 passes serially through a mixing chamber 118 where the streams of entering outdoor air and return room air are mixed; through a filter 119, which removes foreign particles from the air, such as dust, dirt, etc.; a cooling coil 120, of the same general type as the coil 41 previously described and which operates in the summer time to lower the temperature of the air flowing thereover; a humidifying chamber 121 having a water spray device 122 located therein which operates during the winter time to increase the humidity of the air; a suitable type of eliminator 123 which operates to eliminate free moisture from the air flowing from the chamber 121 when the spray 122 is operating; a heating coil 125 of the same general type as the coil 43 previously described and which operates to increase the temperature of the air flowing thereover during the winter time; and a blower 126 which provides for the positive flow of air through the ducts 111 and 112, passage 115, duct 113 and into the room. The blower 126 is operatively connected by a suitable flexible driving belt 127 with an electric motor 128.

In order to regulate the amounts of return room air and outdoor air flowing into the passage 115, the ducts 111 and 112 are provided with damper means 130 and 131, respectively. The damper means 130 may be manually adjusted to any desired position by a knob 132 fixed to a damper shaft 133 journaled in the walls of the duct 111 and to which a damper element 134 is fixed.

The damper means 131 serves to regulate the amount of outdoor air flowing through the main air passage 116. As was the case with the damper means 45 of the previously described modification, the damper means 131 may be adjusted manually to any desired preselected position, and will close automatically in response to changes in an operating characteristic of an air conditioning element in the apparatus 110 when such element fails to operate.

The damper means 131 comprises a shaft part 140 extending transversely across the duct 112 and journaled in opposite walls of said duct and having an extension 141 at one end thereof at the outside of the duct. The damper means 131 also comprises a damper element 142 arranged within the duct 112 and fixed to the shaft 140 by suitable screws 144, so that the element 142 is movable with the shaft to regulate the air flow through the duct 112.

As stated, I provide a manually adjustable means for placing the damper at any preselected position. This means comprises a device for constantly urging the damper element 142 to its wide open position and a manually-adjustable stop device for limiting movement of the damper element by the urging device to any preselected point.

The urging device is in the form of a counterweight 145 fixed to the extension 141 of the damper shaft 140 by a set screw 146, and having a projection 147 extending inwardly from the counterweight toward the adjacent wall of the duct 112 and adapted to engage the manually adjustable stop device.

The stop device comprises a plate member 148 fixed with respect to the duct 112 and including an arcuate-shaped channel part 150 arranged with its open side facing said duct. An arcuate slot 151 is provided in the closed side of the channel 150. The channel 150 and slot 151 are so shaped that they fall within an arc whose center is the axis of the shaft 140. The stop device also comprises an adjusting arm 152 loosely pivoted at one end on the extension 141 and having at its other end a portion 153 adapted to be grasped by the hand of the operator for manual adjustment. The arm 152 is normally movable about its pivotal connection with the extension 141; but may be fixed at any point in its movement by a screw bolt 154 and wing nut 155. The bolt 154 is provided with a head 156 arranged within the channel 150 and a threaded shank which extends outwardly through the

slot 151 and an opening in the arm 152. The wing nut 155 engages the threaded outer end of the shank, as shown. By loosening the wing nut, the arm 152 and bolt 154 may be moved about the axis of the shaft 140 and for the length of the slot 151, and the arm 152 may be fixed at any desired point in its movement by simply tightening the wing nut 155, the latter resulting in the arm 152 and plate 148 being clamped tightly together.

The arm 152 is in the path of movement of the inwardly extending projection 147 on the counterweight 145. The projection 147 will normally engage the arm 152. Therefore, as the counterweight is fixed to the damper shaft, the damper element 142 may be positioned by hand at any preselected point by simply adjusting the position of the arm 152, in the manner previously described.

As stated previously, I also provide a means for automatically moving the damper element 142 to its full-closed position when a selected conditioning element of the apparatus 110 fails to operate. As in the previously described modification, this air conditioning element is shown as being the heating coil 125. The means for automatically closing the damper element 142 when the heating coil fails to operate, comprises a suitable thermostat 160 clamped to the heating coil, a heat motor 161 connected in series in an electric circuit with the thermostat 160, and a flexible chain 162 connected at one end to a lever 163 operated by the heat motor 161 and connected at the other end to a lever arm 164 fixed to the damper shaft. In this modification, the lever arm 164 is formed integral with the counterweight, and the part thereof to which the chain 162 is attached is an outwardly-extending projection 165.

The thermostat 160 operates in response to the temperature of the coil 125 and is of the type which is adapted to maintain an electric circuit closed as long as there is heat in the coil 125, and to open the circuit when the supply of heat is cut off from the coil 125.

The component elements of the heat motor 161 are similar in construction and operate in the same manner as the corresponding elements of the previously described heat motor 81. For this reason, the detail construction of certain of the elements has not been shown. The heat motor 161 comprises an enclosing housing 170 fixed with respect to the side wall of the duct 112, a heating element 171 supported in the housing 170 and connected in series in a circuit with the thermostat 160, a cylinder 172 supported by an end wall of the housing and connected by a capillary tube 173 with the interior of the heating element 171, and an expansible bellows 174 supported at its fixed end within the cylinder 172 and having an operating rod 175 connected to its movable end and projecting outwardly from an end wall of the housing 170. The outer projecting end of the rod 175 is connected to the lever 163, and the latter is fulcrumed at 176 on a bracket 177 fixed to the end wall of the housing 170.

In Fig. 9, the rod 175 and lever 163 are shown in their outermost positions. In this position, a heating fluid is being supplied to the coil 125, the thermostat 160 is closed, the bellows 174 is contracted by the pressure of the fluid in the cylinder 172, and the chain 162 is slack, as shown. With the parts in this position, the position of the damper may be manually changed to any desired point by adjusting the arm 152 in the manner just described. As explained in connection with the operation of the previously described modification, should the supply of heat be cut off from the coil 125, the thermostat 160 will open its electric circuit, the bellows 174 will be extended, the lever 163 moved inwardly toward the adjacent end wall of the housing 170 and thereby pull taut the chain 162, and the latter will result in moving the lever arm 164, counterweight 145, damper shaft 140 and the damper element 142 to the full-closed position.

In order to simplify assembly and repair, the heat motor 161 and plate 148 are fixed to a supporting plate 180, and the latter is fixed to the wall of the duct 112 by suitable screws 181. The ends of the supporting plate are provided, respectively, with outwardly projecting flanges 182 which receive clamping screws 183. The damper-operating mechanism is suitably enclosed by a detachable cover 184, the screws 183 serving to clamp the outer parts of the end walls of the cover against the flanges 182 and thereby hold the cover firmly in place. The cover is provided in its bottom with a slot 186 through which the lower end of the arm 152 extends. In operation, the proper position of the damper element 142 is determined, the wing nut 155 tightened to hold the parts in their adjusted position, and the cover 184 then secured in position. The mechanism will then operate automatically to close the damper element when the supply of heating fluid is shut off from the coil 125 and to open the damper element to the preselected position when the heating fluid is again supplied to the coil 125.

What I claim and desire to secure by Letters Patent of the United States is:

1. In air conditioning apparatus, the combination of means defining an air passage adapted to connect the outside atmosphere with a room space; air conditioning means in said passage; a damper in said passage and movable between full-open and full-closed positions for regulating the flow of air through said passage; a counterweight connected to said damper and positioned to constantly urge the latter towards full-open position; a manually adjustable stop device for limiting movement of said damper by said counterweight to any one of a number of selected positions; and means acting in response to changes in an operating characteristic of said air conditioning means for moving said damper from any preselected open position toward its closed position upon a given reduction in output of said air conditioning means.

2. In air conditioning apparatus, the combination of means defining an air passage adapted to connect the outside atmosphere with a room space; air conditioning means in said passage; damper means in said passage for regulating the flow of air through said passage and including a damper element and a supporting shaft therefor providing for movement of the damper element about a fixed axis between full-open and full-closed positions; a counterweight fixed to said damper means and arranged to urge said damper element constantly toward full-open position; a manually adjustable stop device for limiting movement of said damper element by said counterweight to any one of a number of selected positions; and means acting in response to changes in an operating characteristic of said air conditioning means for moving said damper element from any preselected open position toward its

closed position upon a given reduction in output of said air conditioning means; said last-named means comprising a motor device, a lever actuated by said device between two extreme positions, and a flexible element connecting said lever and said damper means, the lever having sufficient length of movement and the flexible element being long enough to move the damper element against the force of the counterweight from its full-open position to its full-closed position.

3. In air conditioning apparatus, the combination of means defining an air passage adapted to connect the outside atmosphere with a room space; air conditioning means in said passage; a damper in said passage and movable between full-open and full-closed positions for regulating the flow of air through said passage; means for constantly urging the damper towards full-open position; a manually adjustable stop device for limiting movement of said damper by said urging means to any one of a number of selected positions; said device comprising a stationary stop element, a rod adapted to be moved lengthwise by hand and having a plurality of spaced notches formed therein and corresponding in number to the selected positions of the damper and adapted to removably engage said stop element, and a flexible element connected at one end to said rod and at its other end to said damper so that lengthwise movement of the rod results in movement of said damper; and means acting in response to changes in an operating characteristic of said air conditioning means for moving said damper from any preselected open position toward its closed position upon a given reduction in output of said air conditioning means.

4. In air conditioning apparatus, the combination of wall means defining an air passage adapted to connect the outside atmosphere with the room space; air conditioning means in said passage; damper means arranged within said passage and including a shaft arranged transversely of said passage and rotatably supported by said wall means, and a damper element fixed to said shaft and movable therewith between full-open and full-closed positions for regulating the flow of outside air through said passage; said damper shaft including a part extending through said wall means and arranged exteriorly of the passage; means for constantly urging said damper element towards full-open position; manually operated means for moving said damper element to any one of a plurality of selected open positions; and means acting in response to changes in an operating characteristic of said air conditioning means for moving said damper element from any preselected open position toward its full-closed position upon a given reduction in output of said air conditioning means; said last-named means being arranged outside of said passage, and comprising a motor device supported by the outside of the wall means through which the shaft part extends, a first lever movable by said device between two extreme positions, a second lever fixed to said extending shaft part, and a flexible element connecting said levers, the levers being so arranged and having sufficient length of travel and the flexible element being of a length to move the damper element from its full-open position to its full-closed position.

5. In air conditioning apparatus, the combination of wall means defining an air passage adapted to connect the outside atmosphere with the room space; air conditioning means in said passage; damper means arranged within said passage and including a shaft arranged transversely of said passage and rotatably supported by said wall means, and a damper element fixed to said shaft and movable therewith between full-open and full-closed positions for regulating the flow of outside air through said passage; said damper shaft including a part extending through said wall means and arranged exteriorly of the passage; a counterweight secured to said damper means and positioned to constantly urge the damper element towards full-open position; a manually adjustable stop device for limiting movement of said damper element by said counterweight to any one of a number of selected positions; and means acting in response to changes in an operating characteristic of said air conditioning means for moving said damper element from any preselected open position toward its full-closed position upon a given reduction in output of said air conditioning means; said last-named means being arranged outside of said passage, and comprising a motor device supported by the wall means through which the shaft part extends, a first lever movable by said device between two extreme positions, a second lever fixed to said extending shaft part, and a flexible element connecting said levers, the levers being so arranged and having sufficient length of travel and the flexible element being of a length to move the damper element from its full-open position to its full-closed position.

6. In air conditioning apparatus, the combination of means defining an air passage adapted to connect the outside atmosphere with a room space; air conditioning means in said passage; damper means in said passage and including a damper element movable between full-open and full-closed positions for regulating the flow of air through said passage; means providing a flexible seating surface for said damper element to prevent leakage of air when the damper element is in closed position; means for constantly urging said damper element towards full-open position; a manually adjustable stop device for limiting movement of said damper element by said urging means to any one of a number of selected positions; said device comprising a stationary stop element, a rod adapted to be moved lengthwise by hand and having a plurality of spaced notches formed therein and corresponding in number to the selected positions of the damper and adapted to removably engage said stop element, a flexible element connected at one end to said rod and at its other end to said damper means so that lengthwise movement of the rod results in movement of said damper element, and means providing a lost-motion take-up connection between the rod and damper means so as to assure firm closing of the damper element when the stop element engages within an end notch on said rod; and means acting in response to changes in an operating characteristic of said air conditioning means for moving said damper element from any preselected open position toward a closed position upon a given reduction in output of said air conditioning means.

7. In air conditioning apparatus, the combination of means defining an air passage adapted to connect the outside atmosphere with a room space; air conditioning means in said passage; damper means in said passage and including a damper element movable between full-open and full-closed positions for regulating the flow of air through said passage; means providing a flexible seating surface for said damper element to

prevent leakage of air when the damper element is in closed position; means for constantly urging said damper element towards full-open position; a manually adjustable stop device for limiting movement of said damper element by said urging means to any one of a number of selected positions; said device comprising a stationary stop element, a rod adapted to be moved lengthwise by hand and having a plurality of spaced notches formed therein and corresponding in number to the selected positions of the damper element and adapted to removably engage said stop element, a flexible element, means for connecting one end of said flexible element to said rod, a bracket connected to the other end of said flexible element, and means providing a screw-and-slot connection between the bracket and damper element for taking up slack in said flexible element when said damper element and rod are in closed position; and means acting in response to changes in an operating characteristic of said air conditioning means for moving said damper element from any preselected open position toward its closed position upon a given reduction in output of said air conditioning means.

8. An air conditioning unit comprising a casing structure having a room air inlet opening in the upper and rear part thereof, an outdoor air inlet adjacent the room air inlet and at the rear of said casing, and a room air outlet in the upper and front part of said casing; a duct extending rearwardly from the upper rear part of said casing and adapted to connect said outdoor air inlet with the outside atmosphere; damper means including a damper element supported for movement about a substantially horizontal pivot located between said room air and outdoor air inlets and operable between two extreme positions, one of which closes the outdoor air inlet and opens the room air inlet, and the other of which opens the outdoor air inlet and closes the room air inlet; means in said casing defining a passage connected at one end to said outdoor and room air inlets and connected at the other end to said room air outlet; means providing for the positive flow of air through said passage; air conditioning means in said passage; a counterweight fixed to said damper means and arranged to constantly urge said damper element towards said other extreme position; a manually adjustable stop device for limiting movement of said damper element by said counterweight to any one of a number of selected positions; and means acting in response to changes in an operating characteristic of said air conditioning means for moving said damper element from any preselected position other than said one extreme position toward said one extreme position upon a given reduction in output of said air conditioning means.

9. In air conditioning apparatus, the combination of wall means defining an air passage adapted to connect the outside atmosphere with a room space; air conditioning means in said passage; damper means in said passage for regulating the flow of air through said passage, and including a shaft arranged transversely of said passage and rotatably supported by said wall means, and a damper element fixed to said shaft and movable therewith between full-open and full-closed positions; said damper shaft including a part extending through said wall means and exteriorly of said passage; a counterweight fixed to said exteriorly extending shaft part and arranged to constantly urge said damper element towards full-open position, and including as a part thereof a lever arm; a manually adjustable stop device for limiting movement of said damper element by said counterweight to any one of a number of selected positions; and means acting in response to changes in an operating characteristic of said air conditioning means and connected to said lever arm for moving said damper element from any preselected open position toward its full-closed position upon a given reduction in output of said air conditioning means.

10. In air conditioning apparatus, the combination of wall means defining an air passage adapted to connect the outside atmosphere with a room space; air conditioning means in said passage; damper means in said passage for regulating the flow of air through said passage, and including a shaft arranged transversely of said passage and rotatably supported by said wall means, and a damper element fixed to said shaft and movable therewith between full-open and full-closed positions; said damper shaft including a part extending through said wall means and exteriorly of said passage; a counterweight fixed to said exteriorly extending shaft part and arranged to constantly urge said damper element towards full-open position, and including as a part thereof a lever arm and a projecting stop element; a manually adjustable stop device adapted to be engaged by the stop element at different desired points and thereby limit movement of said damper element by said counterweight to any one of a number of selected positions; and means acting in response to changes in an operating characteristic of said air conditioning means and connected to said lever arm for moving said damper element from any preselected open position toward its full-closed position upon a given reduction in output of said air conditioning means.

11. In air conditioning apparatus, the combination of wall means defining an air passage adapted to connect the outside atmosphere with a room space; air conditioning means in said passage; a damper in said passage for regulating the flow of air through said passage, and including a shaft arranged transversely of said passage and rotatably supported by said wall means, and a damper element fixed to said shaft and movable therewith between full-open and full-closed positions; said damper shaft including a part extending through said wall means and exteriorly of said passage; a counterweight fixed to said exteriorly extending shaft part and arranged to constantly urge said damper element towards full-open position, and including as a part thereof a lever arm and a stop element projecting toward said wall means; an arm loosely pivoted on said shaft adjacent said wall means and adapted to be engaged by said stop element; and means for securing said arm at any one of a number of selected points so as to limit movement of said damper by said counterweight to any one of a number of selected positions; and means acting in response to changes in an operating characteristic of said air conditioning means and connected to said lever arm for moving said damper from any preselected open position toward its full-closed position upon a given reduction in output of said air conditioning means.

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